

TIME AND EXPENSES ASSOCIATED WITH THE IMPLEMENTATION OF STRATEGIES TO REDUCE EMERGENCY DEPARTMENT CROWDING

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Introduction: The Emergency Nurses Association and other groups have encouraged the adoption of patient flow improvement strategies to reduce ED crowding, but little is known about time and expenses associated with implementation. The purpose of this study was to estimate the time spent and expenses incurred as 6 Urgent Matters hospitals planned and implemented strategies to improve patient flow and reduce crowding.

Methods: We conducted key informant interviews with members of the hospitals' patient flow improvement teams at 2 points in time: immediately after strategy implementation and approximately 6 months later. A total of 129 interviews were conducted using a semistructured interview protocol. Interviews were recorded, transcribed, and coded for analysis.

Results: Eight strategies were implemented. The time spent planning and implementing the strategies ranged from 40 to 1,017 hours per strategy. The strategies were largely led

by nurses, and collectively, nurses spent more time planning and implementing strategies than others. The most time-consuming strategies were those that involved extensive staff training, large implementation teams, or complex process changes. Only 3 strategies involved sizable expenditures, ranging from \$32,850 to \$490,000. Construction and the addition of new personnel represented the most costly expenditures.

Discussion: The time and expenses involved in the adoption of patient flow improvement strategies are highly variable. Nurses play an important role in leading and implementing these efforts. Hospital, ED, and nurse leaders should set realistic expectations for the time and expenses needed to support patient flow improvement.

Key words: Improvement; Cost; Crowding

In response to longstanding concerns about crowding in hospital emergency departments¹ and mounting evidence that crowding contributes to poor-quality care,²⁻⁴ a number of organizations including the Institute of Medicine, Emergency Nurses Association, and American College of Emergency Physicians have recommended the adoption of patient flow improvement strategies.^{5,6} Several studies point to the effectiveness of patient flow strategies for reducing ED crowding,^{7,8} and some have suggested that

these strategies may be relatively inexpensive to adopt.^{1,8,9} However, there is no information currently available to hospital and ED leaders to effectively estimate the time or expenses associated with implementing strategies to improve patient flow and reduce ED crowding.

This report summarizes findings from a study seeking to identify, document, and describe the time spent and expenses incurred at 6 hospitals as they planned and implemented strategies to improve patient flow and

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TABLE 1

Summary of strategies implemented under UM

Hospital	Improvement strategy	Description of improvement strategy
A	1. Protocols for specialty consultations	The team designed and implemented a new process for requesting and completing specialty physician consultations. The team trained physicians to request consultations through electronic order entry and ED clerks to page the consulting physicians and follow up every 10 minutes if the consulting physician does not respond. The team tracks data on the time it takes for consulting physicians to respond to and complete a consultation, and they share the data with each specialty.
B	2. Standardized registration and triage process	A multidisciplinary Lean/Six Sigma process improvement team was assembled to design a more efficient intake process for nonurgent patients. The team used rapid cycle testing to refine the new process for a nurse and registrar to greet incoming patients, obtain a small number of essential demographic items to create a patient record, and conduct a 3- to 5-minute triage. After the testing phase, implementation required extensive staff training.
C	3. Five-level triage	The team adopted the nationally recognized, Emergency Severity Index 5-level triage system. Implementation was led by 8 frontline nurses and the nurse education coordinator. They met weekly to learn about the Emergency Severity Index using free materials from the Agency for Healthcare Research and Quality and designed the educational curriculum for the rest of the staff. They selected a number of cases to present at the training classes, using real-life patient charts representing the hospital's frequent ED users. They held 2 mandatory 2-hour classes for the nursing staff.
	4. Immediate bedding	The team implemented a new process where incoming patients are immediately directed to an open bed, when available, for triage and registration. The ED director introduced the new process during staff meetings and reminded and monitored staff daily over several months to make sure that the new process was followed. No training sessions were needed.
	5. Fast-track improvement	The hospital hired 4 nurse practitioners to staff fast track. The fast track was also physically separated from the main emergency department so that beds would be dedicated for fast-track patients.
D	6. Fast-track improvement	A multidisciplinary team was assembled to address long lengths of stay in fast track using Lean process improvement. The team identified a dedicated nurse practitioner, nurse, and technician to staff fast track, developed new signage at the ED entrance directing patients to the registration window, made supplies more accessible to fast-track staff, provided education to triage nurses to ensure that mid-acuity patients were not sent to fast track, and enabled fast-track computers to print discharge instructions.
E	7. Mid-track	A physician was placed in triage to expedite evaluation and treatment for a subset of mid-acuity patients. The targeted mid-acuity patients are then sent to an unoccupied space in the ambulatory surgery unit ("mid-track") to receive care from a nurse practitioner until admission or discharge. To implement the strategy, the team hired an emergency physician, had the triage room renovated, created new electronic forms for mid-track patients in the electronic medical record, hired a technician to escort patients from triage to mid-track, and conducted staff training on the new process.
F	8. ED/inpatient department communication tool	The team developed, tested, and implemented a faxed report form that standardizes communication between the emergency department and inpatient units for admitted patients. They created a bed coordinator position and established a daily 2 pm phone call for bed coordinators at all hospitals in the system to discuss occupancy rates and the need for transfers, if necessary.

Adapted from implementation plans submitted by the hospitals to UM.

reduce crowding in their emergency departments. To our knowledge, this study represents the first effort to collect this information from multiple hospitals and disseminate it. Though by no means definitive or generalizable, the experiences of these 6 hospitals provide useful insight into the levels of burden on participating staff, as well as examples of expenses incurred. This information can be used by a hospital to anticipate the types of costs associated with implementing patient flow improvement strategies and to roughly assess the feasibility of undertaking similar endeavors.

Methods

PARTICIPANTS AND SETTING

In June 2008 we recruited 6 hospitals to participate in an 18-month learning network led by Urgent Matters (UM), a national program funded by the Robert Wood Johnson Foundation dedicated to finding, developing, and disseminating strategies to improve patient flow and reduce ED crowding. These hospitals were selected from approximately 50 hospitals that responded to our recruitment letter, forwarded to them by state hospital associations. The 6 hospitals were selected to provide diversity in terms of size, ownership, teaching status, and safety net status.

Each hospital was required to form a patient flow improvement team consisting of a nurse, physician, additional representatives from the emergency department, senior hospital leader, research analyst, and other relevant team members, such as staff from ancillary services and information systems. Each team was required to select at least 1 strategy to improve patient flow and reduce ED crowding, develop an implementation plan, and submit monthly progress reports to the UM staff. Finally, each team agreed to participate in periodic Web seminars, monthly teleconferences, 3 site visits by UM staff, and 3 in-person collaborative meetings. Each hospital received a \$10,000 stipend to cover a portion of the costs associated with participation.

The collaborative was launched in October 2008. The teams were offered examples of improvement strategies but were also told that they could select other strategies, as long as they were designed to improve patient flow/reduce ED crowding, they could be implemented within 3 months, and the impact could be measured. The strategies selected and implemented by the patient flow improvement teams are shown in Table 1. Across the 6 hospitals, 8 strategies were implemented. Initial implementation dates ranged from March to September 2009. There was a modest but statistically significant reduction in the ED length of stay or percent of ED patients who left without being seen at 4

hospitals (hospitals B, C, E, and F) after the implementation of the strategies.

DATA COLLECTION

We conducted 2 rounds of individual interviews with members of the hospitals' patient flow teams and other individuals involved in planning and implementing the patient flow improvement strategies. The first round of interviews was conducted in person between August and September 2009. The interviews were led by 3 experienced qualitative researchers who conducted them in 2-person teams. We conducted a second round of interviews by telephone between January and February 2010, and those interviews were led by 1 researcher. We interviewed 75 individuals during the first round and 54 individuals during the second round, across all 6 sites.

During the first round of interviews, respondents were asked to estimate the time they spent planning and implementing the strategy. Importantly, respondents were asked about the time they spent participating in activities for the UM learning network (eg, monthly conference calls and site visits) separately from activities related to planning and implementing the strategies. The time spent on the learning network activities is not included in this analysis because many of those activities would not have occurred if the hospitals had undertaken the improvement strategies on their own.

During both rounds of interviews, respondents were asked about the additional (ie, new) resources that were obtained to support the strategy, including personnel, purchased equipment and services, and resources pulled from other departments. When purchases were made, we asked about their costs. We did not attempt to itemize the existing resources that were used to support the strategy (eg, computers, beds, and pagers), following the ingredients method,¹⁰ because our objective was simply to illustrate the range of new expenses incurred to support the implementation of a sample of strategies (ie, the expenses that had immediate implications for department budgets). Respondents were also asked about lessons learned from the implementation process and whether the resources allocated were sufficient to support the implementation of the strategies.

The interview questionnaires were reviewed for clarity and content by an expert in qualitative research methods and by a hospital leader who recently implemented a patient flow improvement strategy. Interviews were recorded and transcribed for accuracy. The study design, interview questions, and informed consent procedures were approved by the Institutional Review Board of the Health Research and Educational Trust.

TABLE 2

Hours spent planning and implementing strategies, by position and strategy

Hospital	Improvement strategy	Hospital C-suite	ED directors and quality-improvement leaders	ED department chairs, physicians	ED nurse managers, charge nurses, nurses	ED nurse practitioners, physician assistants	ED clerks, technicians	Registration manager	Inpatient unit floor manager	Data/IT analyst	Total hours by strategy
A	1. Protocols for specialty consultations	33	175	43	0	0	5	0	0	0	256
B	2. Standardized registration and triage process	0	25	1	737	1	13	80	0	0	857
C	3. Five-level triage	0	12	8	997	0	0	0	0	0	1,017
	4. Immediate bedding	0	32	0	8	0	0	0	0	0	40
	5. Fast-track improvement	0	160	0	0	0	0	0	0	0	160
D	6. Fast-track improvement	0	155	72	48	48	24	24	0	0	371
E	7. Mid-track	5	8	35	0	0	0	4	0	13	65
F	8. ED/inpatient department communication tool	21	16	11	91	0	0	0	100	0	239
Total hours by position		59	583	170	1,881	49	42	108	100	13	3,005

IT, information technology.

TABLE 3

Expenses incurred in association with implementation of improvement strategies

Hospital	Improvement strategy	Equipment expenses	Construction expenses	Training expenses	Personnel expenses	Total expenses by strategy
Hospital A	1. Protocols for specialty consultations					\$0
Hospital B	2. Standardized registration and triage process	Purchased 2 computers on wheels: \$16,000		Two nurses attended triage training course: \$16,850		\$32,850
Hospital C	3. Five-level triage 4. Immediate bedding 5. Fast-track improvement		Physically separated fast track from emergency department: \$150,000		Hired 4 nurse practitioners: \$340,000	\$0 \$0 \$490,000
Hospital D	6. Fast-track improvement					\$0
Hospital E	7. Mid-track	Purchased an obstetrics chair: \$12,000	Renovated a triage room: \$8,000		Hired a physician and ED technician: \$300,683	\$320,683
Hospital F	8. ED/inpatient department communication tool	Purchased a fax machine: \$200				\$200
Total expenses by type of expense		\$28,200	\$158,000	\$16,850	\$640,683	\$843,733

ANALYSIS

We organized and analyzed the data using Atlas.ti qualitative software (ATLAS.ti Scientific Software Development GmbH, Berlin, Germany). We reviewed responses to the questions about staff time and expenditures and analyzed responses at the strategy level. To facilitate comparisons of time across strategies and hospitals, we assigned each staff member who participated in planning or implementation of a strategy to 1 of 9 job categories, based on his or her title and role. Our results show the total number of hours spent planning and implementing each strategy by all individuals within a given job category, rather than the total number of individuals who participated in the planning and implementation. For example, if 6

emergency nurses each spent 10 hours planning or implementing a strategy, we report a total of 60 hours for emergency nurses.

To generate estimates of the expenses incurred during the implementation of each strategy, we used data on the cost of purchased goods and services provided by the respondents. We included salary data if the strategies involved hiring new staff. The purchased goods and services (eg, computers and fax machines) represented 1-time costs. However, the addition of new personnel is an ongoing cost. Because the purpose of this effort was to identify expenditures incurred during implementation, we report only the salary costs for the first year. We obtained median annual salaries for the relevant positions from

national surveys. Emergency physician salary data were obtained from the 2009 American Medical Group Association Compensation and Financial Survey¹¹; nurse practitioner salary data were obtained from the 2009 National Salary and Workplace Survey of Nurse Practitioners conducted by *ADVANCE for Nurse Practitioners*, an industry journal¹²; and data for emergency technicians and paramedics working in hospitals were obtained from the Bureau of Labor Statistics' 2009 Occupational Employment Statistics survey.¹³ We shared our time and expenditure estimates with the leaders of the hospital patient flow improvement teams and incorporated their feedback.

We followed an inductive approach for analyzing responses to our questions about lessons learned and the adequacy of resources to support implementation. Two researchers initially reviewed all of the responses related to time and expenses and developed a coding strategy that was applied to the transcripts by a single researcher. Following a constant comparative method, the researcher compared newly coded text segments with text segments that had been previously assigned using the same code to ensure that they were properly assigned and reflected the same concept.^{14,15} The researchers met frequently to discuss progress and concepts that emerged from the coding process.

Results

STAFF TIME

Reported hours spent planning and implementing the strategies are shown in Table 2. Total hours ranged from 40 to 1,017. There are several factors that contributed to the variation in total hours. First, the most time-consuming strategies were those that involved extensive, standardized training of staff. For example, adoption of the Emergency Severity Index 5-level triage system (hospital C) required designing and conducting a training course for the entire ED nursing staff. Similarly, triage training represented the majority of hours spent planning and implementing the standardized registration and triage process (hospital B). At hospital C, 40 nurses received triage training, whereas only 27 were trained at hospital B, resulting in 260 more training hours at hospital C.

Second, strategies that involved a larger number of individuals were generally more time-consuming. For instance, hospitals C and D both implemented strategies to improve patient flow in their fast tracks and established dedicated fast-track teams. Hospital C used a top-down approach (with planning conducted by the ED director and assistant director), so the number of individuals involved in planning and implementing the strategy was

limited. Conversely, hospital D used Lean, a process improvement methodology for reducing inefficiency and waste, which involves participation from multiple team members. Hospital D's team consisted of 3 physicians, 2 nurses, 2 nurse practitioners, 1 technician, 1 registration manager, and 3 quality-improvement facilitators. As a result, total planning and implementation time was considerably higher than at hospital C.

Other factors explaining the variation in hours across strategies are the complexity of the strategies and the extent to which the strategies represent a significant change to ED processes. The strategy that was reportedly least time-consuming to plan and implement was the immediate-bedding strategy (hospital C). The strategy was planned by the ED director, assistant director, and nurse educator, who simply announced the policy change during staff meetings. It was a relatively straightforward change in protocol that did not require staff training or a large number of planning meetings. Conversely, development of a new protocol for requesting physician specialist consultations (hospital A) was a relatively complex strategy that involved gathering data to study the problem, developing a new system for tracking consultations, and educating clerks and physicians on the process.

Table 2 also identifies the types of individuals involved in planning and implementing the strategies. ED administrative directors or quality-improvement leaders, the vast majority of whom were nurses, were involved in planning and implementing all of the strategies. Often, they served as the leaders of the initiatives. Hospital C-suite or director-level individuals were involved in 3 strategies. Although they were not involved in the day-to-day implementation, they typically lent their support during the planning stages, for example, suggesting strategies for implementation. Overall, emergency nurse managers, charge nurses, and staff nurses spent more time planning and implementing strategies than others, primarily because several of the strategies involved nurse training.

EXPENSES

Of the 8 strategies proposed under the learning network, 5 required little or no new expenditures ($\leq \$200$) (Table 3). Many of these interventions involved a simple process change, a change in policy, or a shift in staff responsibilities, rather than the addition of new staff or equipment. For example, with the immediate-bedding strategy (hospital C), the charge nurses direct incoming patients immediately to an open bed, if available, for triage and registration. This represents a change from the previous protocol of conducting triage and registration in the front of the emergency department and

directing patients to the waiting room until the nurses were ready to see them. Another example of a low-cost strategy is the fast-track improvement initiative (hospital D), which called for the establishment of a dedicated fast-track staff team. Under the strategy, a nurse and technician joined a nurse practitioner and registrar to staff the fast track consistently. The hospital did not hire a new nurse and technician but instead shifted staff from elsewhere in the emergency department. Those positions were never replaced.

Two strategies involved significant expenses. Hospitals C and E added staff and planned construction projects to support the fast-track improvement and mid-track. Hospital C undertook a construction project (\$150,000) to physically separate the fast-track area from the emergency department so that fast-track staff and beds would not be used for ED patients when the emergency department experienced crowding. In addition, 4 nurse practitioners were hired to staff the fast track (salary estimated at \$85,000 for each). For mid-track at hospital E, 1 emergency physician was hired (\$267,293) to provide triage and initial treatment to a subset of mid-acuity patients in a renovated triage room (\$8,000). This enabled patients who traditionally wait the longest and have the highest rate of leaving before being seen to be evaluated by a physician much more quickly. A technician was also hired (\$33,390) to escort these patients to a separate area where a nurse practitioner continues treatment under the guidance of the emergency physician. An obstetrics chair was purchased (\$12,000) for this separate area.

A final strategy, standardized registration and triage process (hospital B), involved moderate expenses. The hospital adopted a zoning strategy for registration (ie, assignment of 1 registrar to a set of geographically close rooms), which required the addition of 2 computers on wheels (\$8,000 each). In addition, 2 nurses attended a train-the-trainer triage course (\$16,850).

LESSONS LEARNED AND PERCEPTIONS OF SUFFICIENCY OF RESOURCES

We asked respondents about lessons learned during the implementation of the strategies. Several said that more time should have been allocated to staff training. For example, reflecting on the implementation of mid-track, a respondent from hospital E said, "Whenever you start a new process, you always find that the time you've allocated for education is never enough, and that the education component takes more effort and more time than anticipated." After rolling out the new triage system at hospital C, nurses conducted chart audits to assess Emergency Severity Index compliance and identified a number of errors. As a result,

additional training sessions had to be held approximately 6 months after rollout. Similarly, respondents said that more time should have been allocated to training clerks on their responsibilities associated with the protocol for specialty consultations (hospital A). Clerks were responsible for requesting the consultations and monitoring when the consulting physicians arrived in the emergency department and completed their consultation. Respondents speculated that additional training might have reduced some of the miscommunication about the new process between clerks and consulting physicians.

Respondents indicated that certain implementation steps took longer than expected to complete, delaying the timeline for implementation. For instance, respondents from hospital F said that it took longer than expected to obtain input from all parties on the inpatient report tool, which was used to facilitate communication between the emergency department and inpatient units. For the implementation of the standardized triage and registration process at hospital B, it took longer to purchase computers on wheels because of capital constraints.

Not surprisingly, respondents from 2 of the 6 hospitals noted that additional resources would have strengthened their strategies. As mentioned earlier, the fast-track improvement strategy at hospital D is supported by a nurse and technician who were previously assigned to another area of the emergency department. As one respondent noted, "We robbed Peter to pay Paul." Several respondents from hospital D mentioned that it would have been preferable to hire new staff to support the fast track, but budget constraints did not permit it. At hospital E, several respondents said that the newly established mid-track was working so well that it would be preferable to extend the hours. However, the space for mid-track is only available after 3 pm (ie, after the ambulatory surgery unit closed).

Discussion

Several insights emerge from these findings that may be useful to hospital leaders seeking to improve patient flow in their emergency departments. At the most basic level, there is considerable variation in the time and expenses associated with implementing strategies to improve patient flow and reduce ED crowding. Across just these 8 improvement strategies, total implementation hours ranged from 40 to 1,017. Strategies that involved staff training, large implementation teams, or complex process changes were generally more time-consuming than other strategies. Five strategies required minimal resource expenditures. Among the 3 remaining strategies, new expenditures ranged from \$23,850 and \$490,000, with the

majority of costs related to the acquisition of new personnel. But what else have we learned?

First, our study shows that it is overly simplistic to say that patient flow improvement efforts are inexpensive to implement, as some investigators have asserted.^{8,9} There are indeed some relatively low-cost patient flow improvement strategies. These strategies tend to be simple process changes, such as immediate bedding and the ED/inpatient department communication tool undertaken by hospitals C and F. For the many hospitals that have not yet begun to address the challenges of ED crowding, these types of process changes are an obvious place to start. A recent survey found, for example, that only two-thirds of hospitals nationally have adopted bedside registration, despite the low cost and strong evidence base associated with this strategy.¹⁶ However, for those hospitals that have already implemented the simple process changes, further actions to address ED crowding may require the adoption of more sophisticated strategies that require substantial investment in both staff time and money. Among our study hospitals, we see that the mid-track strategy requires new dedicated space and staff, the validated triage system requires extensive staff training, and the protocols for specialty consultations require substantial planning time.

A second finding of our study is the need to allocate sufficient staff time to planning and implementation. The absence of prior literature on the time required to implement patient flow improvement strategies suggests that this important component has been largely overlooked. Our results indicate that staff time needed for implementation is often substantial, particularly when extensive training is required. Indeed, several of our respondents said that they should have budgeted more time for staff education. Although it may be tempting for hospitals to form small teams or minimize staff training in an effort to reduce total planning hours, dedicating ample time to these tasks up front may reduce miscommunication and/or the need for more retraining later on.

Third, our study points to the need to recognize the often ignored importance of the roles played by registrars, clerks, technicians, and others in the successful adoption of strategies and the need to include them in planning and implementation. Unlike nurses and physicians, these individuals are unlikely to be members of professional societies that offer educational materials on the issue of ED crowding. Organizations that provide guidance and technical assistance for hospitals to improve patient flow might consider ways to better engage these individuals in performance improvement activities.

The investment associated with implementation of patient flow improvement strategies may be dwarfed by

the additional revenue associated with patients who would have left without being seen in the absence of the strategies. However, as noted earlier, the changes in length of stay and percent of patients who left without being seen at these hospitals were modest. An investigation of the return on investment was beyond the scope of this effort, but we recommend that future research investigate whether certain strategies consistently generate a larger return on investment to better inform future improvement efforts by hospitals.

Limitations

There are several limitations of this study. First, the study included only 6 hospitals, and their implementation experience was shaped by participation in the collaborative, so the external validity of our findings is limited. Hospitals adopting similar strategies on their own may be less likely to form large teams, and the number of individuals and total hours involved may be lower. On the other hand, the hospitals participating in the collaborative were required to implement their strategies within 3 months. Hospitals working on their own may be less compelled to follow a rigorous timeline, and a longer implementation time frame could result in more hours spent planning and implementing.

In addition, this effort only considered the costs of newly purchased resources. It did not consider the costs of resources borrowed from other departments or the cost of staff time devoted to planning and implementing the strategies. Furthermore, we considered only upfront costs, but many of the strategies will have long-term, recurring costs. For example, additional staff training will be needed as the hospitals experience turnover. Finally, our time estimates were based on reports by respondents. We did not ask respondents to keep a daily log of hours spent working on the strategies, so respondents' reports of hours may be prone to error. Moreover, we excluded the time spent on the learning network activities (eg, monthly progress reports and conference calls), but some of the collaborative activities facilitated planning and represent time that hospitals may need to spend even if they implement improvement strategies on their own.

Implications for Emergency Nurses

Our findings show that emergency nurses play a key role in planning and implementing patient flow improvement strategies. Emergency nurses in leadership positions within the department or hospital (eg, ED director or quality-improvement leader) are often tapped to spearhead patient flow efforts, and staff nurses are often responsible for

implementation. These findings suggest a need for nurses to receive information on the importance of improving patient flow, best practice strategies, and process improvement techniques. On the basis of the lessons learned from UM hospitals, nurses leading patient flow improvement initiatives should establish implementation timelines that allow for sufficient staff training and other delays that may arise.

Conclusions

This study provides important preliminary data on the time and expenses involved in the adoption of patient flow improvement strategies and lessons learned from the experience of 6 hospital teams. Our findings indicate that nurses play an important role in leading and implementing these improvement efforts. Our results may offer guidance to hospital and department leaders and nurses on setting appropriate expectations for the time and expenses associated with implementation.

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